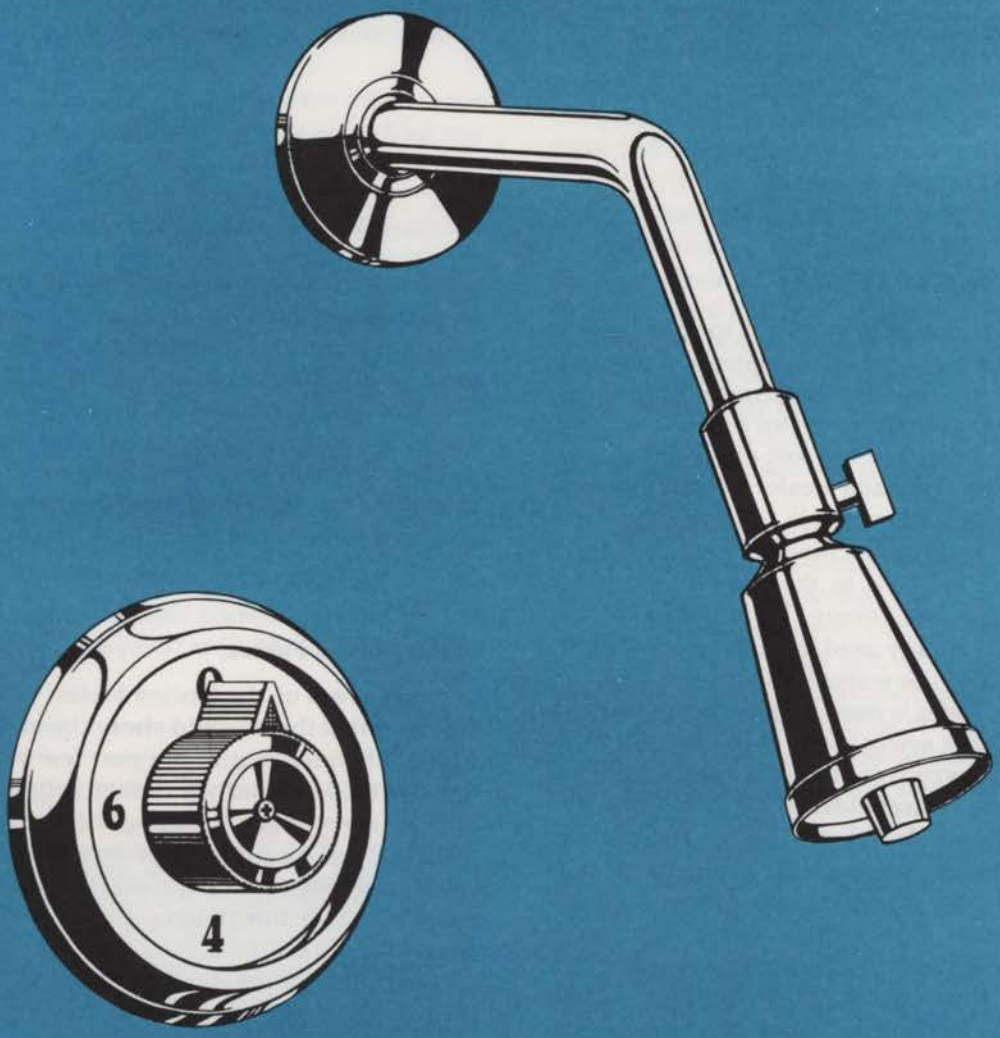
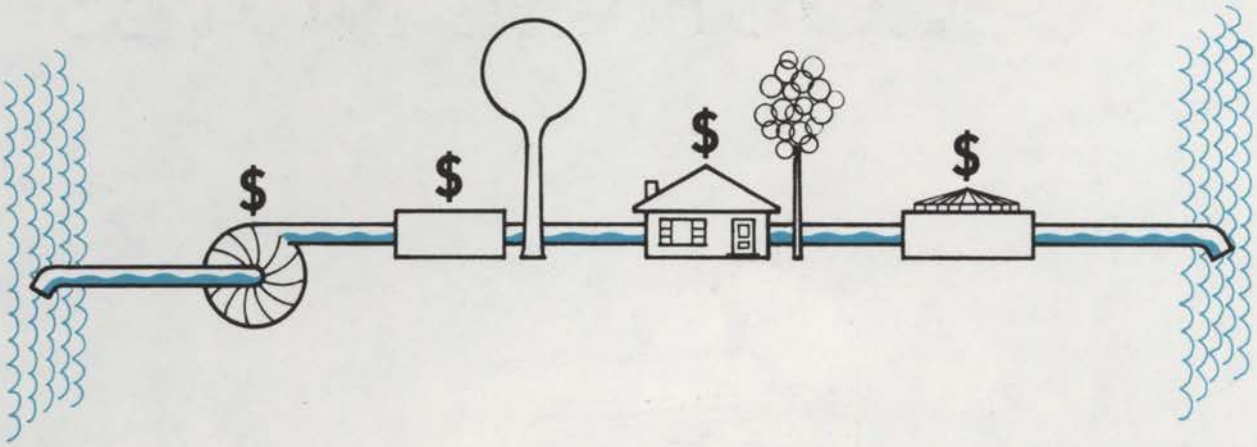
University of Illinois at Urbana-Champaign
Small Homes Council-Building Research Council

COUNCIL NOTES



C1.6 WATER CONSERVATION

Water Conservation C1.6 Volume 2 Number 3 Winter, 1977 Twenty five cents



WATER CONSERVATION

This brochure has been prepared to show how to save a substantial amount on water and fuel bills while helping to conserve both water and energy.

Water in the home is paid for both through the water bill and through the cost of the gas or electricity used by the water heater. If the hot water use is reduced – for example, running the dishwasher and washing machine only with full loads and reducing the flow to the shower, the water heater will use less energy. It's quite likely that the cost of the energy used to heat water is greater than the cost of the water itself.

After the water is used, it goes down the drain and through the sewer pipes to the sewage treatment system, which is supported through direct charges to the householder or by tax dollars. The more sewage produced, the higher the costs of operating the treatment plant. The primary purpose of that system is to treat toilet wastes, but it must also treat all the other water that comes through the system. The less water sent through the system, the better it can cope with the toilet wastes, thus helping to avoid or postpone the expense of building additional sewage treatment plants to handle an increasing volume of waste.

COUNCIL NOTES Volume 2 Number 3 Winter, 1977

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While the reduction in flow through a municipal sewage treatment plant through the use of water saving devices and changes in living habits may not be significant, large reductions in the sewage flow to disposal systems on the owner's lot can be made. It may be possible to reduce sewage flows up to 40% for these systems. This could affect the size of the household treatment system, and may also permit increased use of soils which are poorly suited for septic tank drain fields with present systems.

Water for the Future

In many areas of the United States, people have assumed that there would always be an abundant supply of water. But in the past few years it has become evident that we cannot squander water forever, even where it has been abundant in the past. Recent drought years have lowered lake levels, reduced river flows, and depleted shallow aquifers while threatening some of the deeper ones.

Some areas have always been subject to localized short-period drought when rainfall was insufficient, but other factors have also begun to affect our water supply. The babies born during the population explosion following World War II are now setting up their own households at a national rate of 2 million per year. These new homes need a supply of fresh, clean water. Also, as households in small communities have converted from individual wells to community distribution systems, homeowners have become less careful about how they use water. At the same time, we are still fighting to clean up our polluted waters. Thus, more people need water at a time when less pure water is available.

How You Can Save

How can water use be cut? Three simple ways are: checking for leaks, developing water-saving habits, and installing water-saving devices. Such devices are usually inexpensive and easy to install.

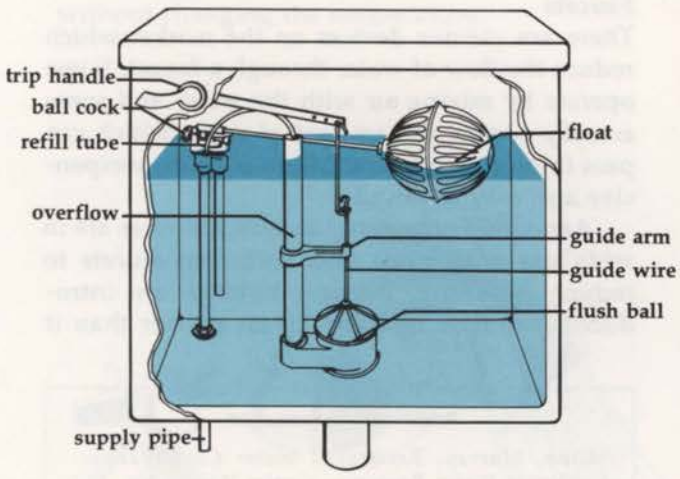
Stopping Leaks

Leakage accounts for between 5 and 10% of all residential water consumption. Most of this leakage is due to worn-out faucet washers and faulty toilet tank valves. Correcting these costly leaks is usually the easiest and least expensive way to reduce water consumption.

Faucets. A leaking faucet wastes more water than most people realize. A leak of 1 drop per second can waste 7 gallons per day. A steady drip will waste 20 gallons per day.

Faucet leaks are easy to see and comparatively easy to repair. Installing a new washer, a simple task, will usually correct the leak. If the faucet begins leaking again soon after the washer is changed, it may be necessary to replace the valve seat because it probably has a small scar on it which cuts the washer. "Do-it-yourself" books or hardware store personnel may provide useful advice.

Toilets. A more serious type of leak occurs in toilet tanks, which can waste 200 gallons of water a day without making a sound. Since the leaking water runs from the tank into the bowl, it can't be seen. At water rates of $1 to $3.30 per 1,000 gallons, such a leak could cost $6 to $20 per month. Several things can cause toilet tanks to leak, and most of them are easy to repair.



The conventional toilet flush tank operates when the trip handle raises the flush ball, allowing the water from the tank to flow into the toilet. The flush ball is hollow and traps a bubble of air, which causes it to float until the tank is nearly empty, when it drops and shuts off the flushing action. The tank is refilled when the float drops, opening the ball cock. The toilet bowl is refilled by water coming through the refill tube into the overflow while the tank is filling.

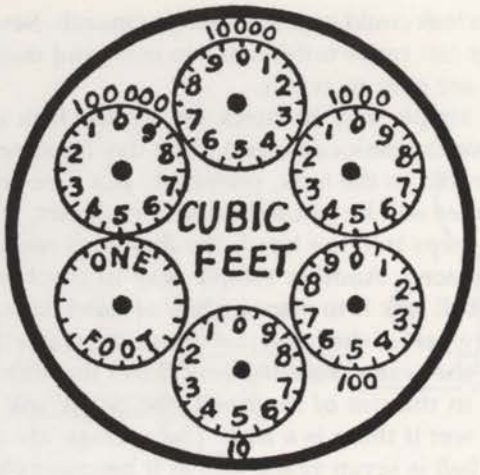
A simple way to check for a toilet leak is to remove the tank cover and place dye (food coloring or ink) in the tank, preferably at a time when the toilet will be unused for several hours. If the color seeps into the bowl, the flush ball needs to be replaced. Another simple way to check for a flush ball leak is to place a piece of toilet paper on the dry part of the bowl just above the water line. Since the water from the leak flows through the holes in the rim of the bowl, the paper will become wet if there is a leak. The average life of a flush ball is seven years, and as it becomes older, the possibility of a leak increases greatly. A new flush ball can be purchased for less than $2, and it might be a good policy to change the flush ball every 5 years just to be safe.

Infrequently, the valve seat is scarred and needs replacing. It can be tested by running a finger around the seat to see if it is completely smooth. It should be free of dirt or corrosion, which would prevent a complete seal. Original seats are generally brass and may be replaced by a plumber. A kit which bonds a new seat to the old one with an adhesive is available for do-it-yourselfers.

Obviously, if the toilet tank continues to make noise after the flush-and-fill cycle is completed, something is wrong within the tank. Usually the problem is caused by the flush ball not fitting properly into its valve seat. This misfit is often caused by a bent or corroded guide wire or an improperly positioned guide arm. A replacement for the flush ball is available which uses a flapper assembly, eliminating the need for the guide wire and guide arm.

There are two other common causes of loss of water that can be detected easily. If the water level in the flush tank is above the overflow tube, water will continually run out. This problem occurs because the float is set too high or the ball cock is leaking. The water level in the tank should always be at least ½ to 1 inch below the overflow tube to avoid leakage. If the ball cock is leaking, water may run directly into the overflow through the refill tube. Lowering the float or repairing the leak in the ball cock will prevent these losses.

Another reason for the water to run out of the tank continually is a defective float. If the float leaks, it will not rise high enough to shut the water off after the tank refills, and water will overflow into the bowl. You can test the float by taking it off and shaking it. If you hear water inside, it should be replaced. Foam plastic balls cannot become waterlogged.



Reading the Water Meter

After the faucets and toilets have been checked for leaks, there is one more thing that can be done to be positive that there are no leaks. The water meter should be read both before and after a period of several hours when no water is being used in the house. An ideal time would be overnight, particularly if the family is warned in advance not to run water during the night. If the meter reads exactly the same in the morning as it did the night before, there is no leak.

To read a dial-type water meter, look first for the cubic-foot dial on the meter. It has the words "one foot" written on it. To be certain which dial it is, watch the meter when a toilet is flushed; the cubic foot dial will move, probably at least halfway around the circle. One complete turn indicates that one cubic foot (or 7.48 gallons) has been used. The next dial to locate is immediately next to the cubic-foot dial and has the number 10 written below it. Each time the indicator moves from one number to the next on this dial, it indicates the use of 7.48 gallons. When the indicator has gone completely around the dial, 10 cubic feet (or 74.8 gal.) have been used. By reading these two dials you can determine exactly how much water you are using for any activity, such as showering, washing clothes, or dishwashing.

All the dials on the meter may be read to keep a monthly check on the water used. The dials are read in order, beginning with the dial marked 10 and continuing to 100, 1000, 10,000, and 100,000. If a pointer seems to be directly on a figure, it should be read as the lower figure unless the pointer on the next lower dial has passed zero.

Some water meters read directly, much like the odometer in a car. Just as the dial-type meters, they read in cubic feet of water, not gallons.

Water Usage

Most of the water used in the home is used to flush toilets. Table 1 gives an estimate of the amounts of water used by various appliances. These numbers are approximations because usage depends upon the make of the appliance and on the water-using habits of the household. For instance, both the length of a shower and the type of shower head can make a difference in the amount of water used.

The exact amount of water used by any appliance or activity can be found by reading the water meter before and after use. For accuracy, no water should be used elsewhere during the appliance or activity cycle. This information can help determine the water use and wastage in the home.

Table 1

Activity	Water Use
Toilet	5 gal/flush
Shower	4 gal/min
Tub bath	30 gal
Dishwasher	14 gal/load
Clothes washer	50 gal/load
Lavatory faucet	2 gal/load
Garden hose	
1/2"	360 gal/hr
5/8"	600 gal/hr
3/4"	1140 gal/hr
Leaks	
1 drop/second	7 gal/day
steady drip	20 gal/day
1/32" trickle	200 gal/day

Water-Saving Devices

Faucets

There are various devices on the market which reduce the flow of water through a faucet. Some operate by mixing air with the water and some actually control the amount of water which can pass through the faucet. Most are quite inexpensive and easy to install.

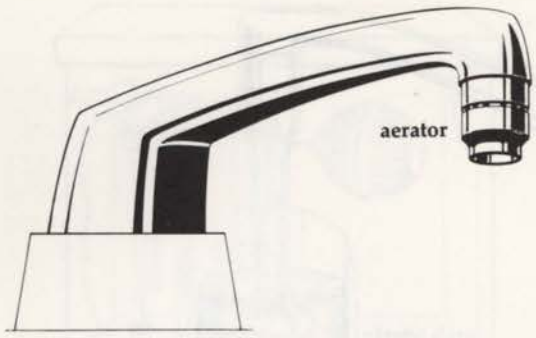
Aerators. These easily installed devices are in wide use on kitchen and bathroom faucets to reduce splashing. Because bubbles are introduced, the flow of water seems greater than it

Additional Information

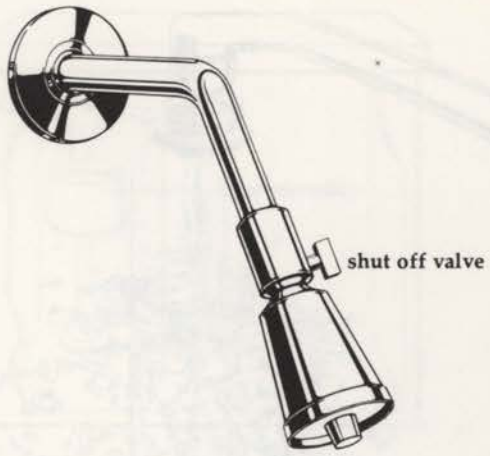
Milne, Murray. *Residential Water Conservation.* California Water Resources Center Report No. 35, University of Calfornia/Davis, March 1976.

Sharpe, William. *Water Conservation and Wasteflow Reduction in the Home.* The Pennsylvania State University Cooperative Extension Service, University Park, PA.

Simple Plumbing Repairs for the Home and Farmstead. Farmer's Bulletin No. 2202, U.S. Department of Agriculture, Washington, D.C., October 1970.



An aerator on a faucet reduces the tendency for the water to splash and makes a lower flow rate seem larger.

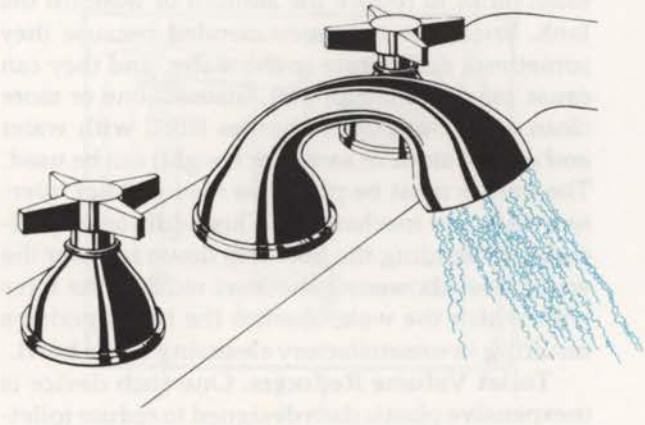


A shutoff valve near the shower head allows the user to turn off the water while lathering without disturbing hte temperature adjustment of the shower controls.

actually is. Prices vary, depending on the material and the number of screens within the aerator.

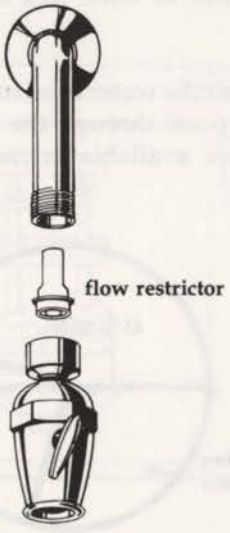
Spray Taps. Spray taps do not aerate the water but instead deliver it in a broad pattern like a small shower head. They are in common use in Europe but are fairly new in America.

Thermostatic Mixing Valves. These valves permit mixing of hot and cold water to preset temperatures. Thus, water is not wasted in adjusting the hot and cold water taps. This feature is particularly valuable in the shower, since it enables the user to turn off the water while soaping or shampooing and then turn the water back on to the preset temperature for rinsing. If there is no mixing valve in the shower, it is possible to buy a small device to be inserted between the pipe and the shower head which will temporarily cut off the flow of water from the shower head without changing the temperature.



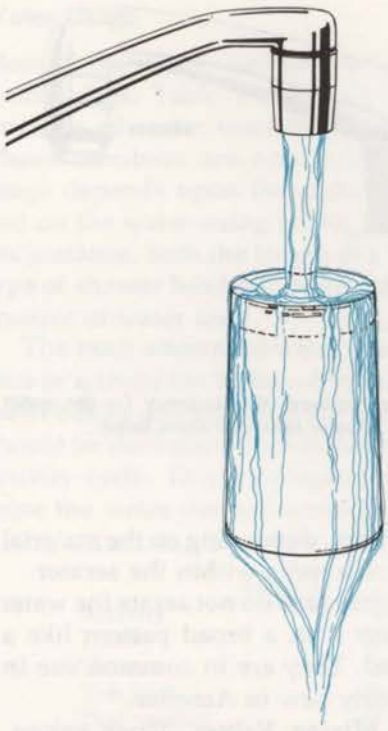
A spray tap does not introduce air into the water stream, but does spread the stream like a shower head, making a low water flow more efficient for rinsing.

Flow Regulators. There are two types of flow controllers – those that simply reduce the flow of water by creating a smaller opening (the orifice or restrictor type) and those that actually maintain a constant flow rate regardless of changes in water pressure (called a constant-rate device). Water pressure variations are not common in large public water supply systems but may occur in individual systems. The constant rate device is most valuable in cases of very high water pressure. A small plastic internal flow restrictor for the shower is shown below. A similar device is available which is inserted between the pipe and the shower head.



Since some shower controls only regulate the temperature of the water and not the quantity, a flow restrictor at the shower head will help conserve water.

While aerators reduce the tendency to splash, rinsing is still relatively inefficient.



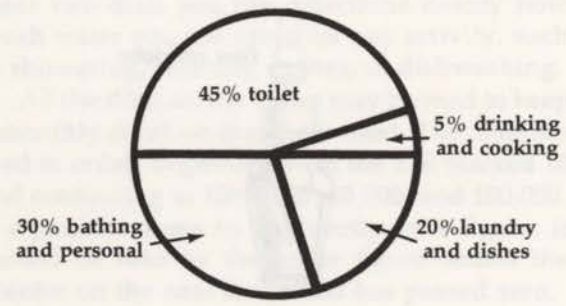
A "laminar flow" device causes less splashing, allowing the water to "cling" to the object being washed.

Devices that maintain a constant flow regardless of changes in water pressure are slightly more expensive (usually less than $10). One regulator also features a "laminar flow" effect so that the water clings to the object being washed.

Generally, a flow reduction to 2 gallons per minute is recommended for lavatory faucets and 3 gallons per minute for shower heads. A flow-control device is not recommended for the kitchen faucet, where it may be necessary to obtain a large volume of water in a short period of time.

Toilets

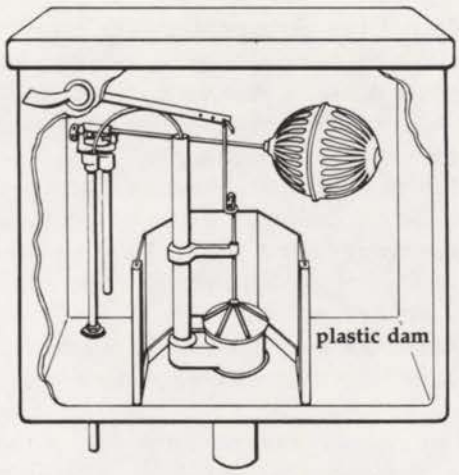
Almost half the water used in the home is used for waste disposal through the toilet. A great many devices are available to reduce the amount of water used to flush the toilet. Water saving devices such as are described below do not work equally in all brands and types of toilets, and some are more effective than others. Some devices may require two flushes to remove all solids from the bowl; if so, they should probably be removed since they may actually increase water consumption. New toilet designs are appearing which eliminate this difficulty.



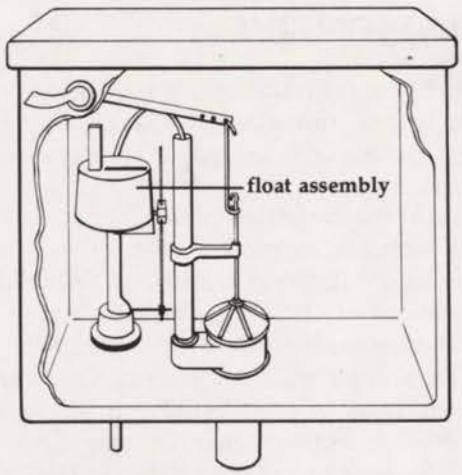
Water use in the home.

Plastic Bottle. When the public first became conscious of the great amounts of water that were used in toilet flushing, many newspaper and magazine articles recommended placing bricks in toilet tanks to reduce the amount of water in the tank. Bricks are not recommended because they sometimes deteriorate in the water, and they can cause breakage if dropped. Instead, one or more clean plastic one-quart bottles filled with water and a small stone or sand (for weight) can be used. The bottles must be placed so they will not interfere with the mechanism. This addition is preferable to bending the float arm down to lower the water level. Lowering the level reduces the force with which the water flushes the bowl, perhaps resulting in unsatisfactory cleansing of the bowl.

Toilet Volume Reducers. One such device is inexpensive plastic dam designed to reduce toilet-flush water by 50%. The water in the lower part of the tank is prevented from flushing into the bowl, but the water level itself is not lowered.



A small plastic dam installed around the flush valve reduces the amount of water flowing from the flush tank into the toilet bowl without reducing the force with which it flows.

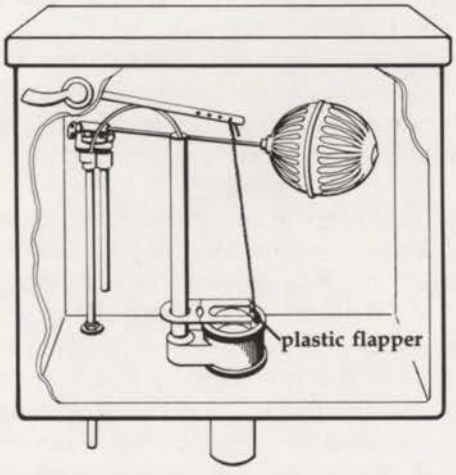


An improved float valve refills more rapidly and signals the presence of a leak at the flush ball.

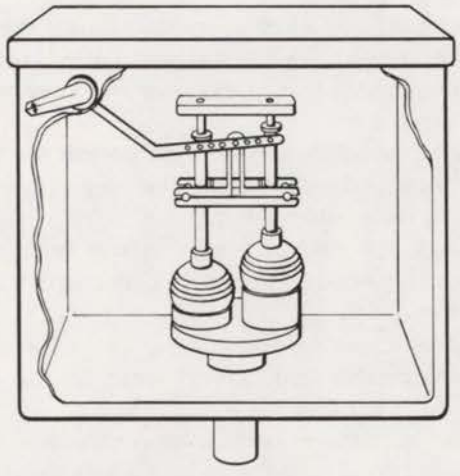
Improved Float Assemblies. Float assemblies of improved design (eliminating the float and rod arm) save money both because they require less maintenance and because the water level can be adjusted easily, allowing it to be set at a level at which the toilet flushes efficiently while saving water. A float device that signals leaks is shown above right; each time the tank leaks a gallon the valve will open and quickly refill the tank. The sound of the tank refilling periodically at short intervals indicates that there is a leak to be repaired. (With a conventional ball cock the tank refills constantly if there is a leak, and noise might not be noticed.) These devices shut off much more quickly after a flush and thus are quieter.

Dual Flush. An interesting variation is the mechanism which makes it possible to select a small or large flush for either liquid or solid wastes. A single handle is pressed in one direction for a partial flush and in the other direction for a full flush. The device replaces the existing flush mechanism but uses the existing fill system.

Shallow Trap Toilet. If a toilet is to be replaced, or selected for a new house, there are shallow-trap toilets available which use only about 3½ gallons of water for each flush instead of the usual 5 to 7 gallons. These toilets are now being made by several large plumbing manufacturers and are competitively priced. In some states they are required in all new plumbing installations.



A "flap" type of flush valve replaces the flush ball and its system of wires and guides. Bent or binding guide wires are a major cause of flush ball leaks.



A dual flush mechanism permits a full flush to remove solids if the trip handle is moved in one direction, and a partial flush for liquid wastes if moved in the other direction.

WATER-SAVING TIPS

☐ Don't use the toilet simply to flush away facial tissues, paper, and other similar solid and liquid wastes (using a wastepaper basket is a lot cheaper).

☐ Flush the toilet less often. In most cases, several uses can be made of the toilet for liquid wastes before flushing is required. A deodorant and colorant block in the flush tank may make this practice aesthetically more acceptable.

☐ Take shorter showers. Unless a shower lasts seven minutes or less, bathing in the tub will use less water and will conserve energy. A kitchen timer is a useful bathroom accessory. The "Navy" shower – use water to get wet, turn off water while lathering, turn on water to rinse – uses the least water. The amount of water used in a tub-shower is easily determined by closing the drain during the shower.

☐ When filling the tub, don't let water run down the drain until it gets hot. Instead, close the drain before turning on the faucet. The water will soon be hot and the temperature can be adjusted later as the tub fills.

☐ Do not let faucets run for washing or rinsing. Always fill a container with water for this purpose or use the sink by stoppering the drain.

☐ Use a brush, wash cloth, or your hand to dislodge particles of dirt when washing anything rather than relying on the force of the water to do the job.

☐ Turn off the water while brushing your teeth; this step can save a family 5 to 10 gallons per day (or 3650 gallons a year).

☐ Rinse hand razors in the filled sink rather than under running water.

☐ When shampooing, turn off the water while lathering the hair.

☐ When filling a kettle, try to estimate the exact amount needed; leaving unused boiled water on the stove means that both water and energy have been wasted.

☐ Use plastic ice trays which permit the cubes to be loosened by twisting the tray rather than running water over the tray.

☐ Keep a bottle of water in the refrigerator rather than letting water run in the sink to get a cool drink.

☐ When cleaning vegetables, use a filled sink and a vegetable brush, and wash all the vegetables for a meal at once.

☐ Use only the minimum water to cook foods; flavor and food value may be wasted along with water.

☐ "Recycle" the water used to cook vegetables by using it in soups to add flavor and nutrients.

☐ Do not use garbage disposals except at the end of cooking or clean-up periods or when full. Whenever possible, don't use the disposal at all; compost vegetable peelings for your garden or put them in the garbage can.

☐ Run an automatic dishwasher only with full loads. Do not prewash dishes unless necessary. To save energy, turn the dishwasher off at the start of the dry cycle, open the door, and let the dishes air-dry.

☐ Do not use the extra-long prewash and scrub cycles on the dishwasher unless absolutely necessary.

☐ Run clothes washers only with a full load unless a reduced fill setting is available. Use "warm" or "cold" settings if possible.

☐ Water the lawn in the early morning to avoid evaporation losses.

☐ For successful lawn irrigation, irrigate slowly, deeply, and infrequently.

☐ Do not allow sprinkler water to flow into a gutter.

☐ Avoid sprinklers that produce a fine mist; too much water is lost in wind and evaporation.

☐ Use an alarm clock or the stove timer to remind you to shut off the sprinklers.

☐ In arid areas, use desert landscaping which does not require watering.

☐ Use pistol-grip nozzles (spring shut-off) on all hoses to avoid waste, and always turn off the faucet tightly when through to prevent leakage.

☐ Reduce evaporation losses from flower and vegetable gardens by using an organic mulch or plastic ground cover between rows.

☐ Sweep sidewalks and driveways instead of washing them down with the hose.

☐ Collect water from roof gutters to use for lawn and plant watering.

☐ Do not water lawns or wash cars when water is in short supply.

☐ When washing the car, rinse it once, then use a bucket of soapy water to wash it, and then give it one more quick rinse. Taking it to a car wash may save water, since many commercial installations recycle their water.

☐ When you go on a vacation, turn off the water to the house; a leak while you are away could be expensive and do a lot of damage. Be sure, however, to turn off the water heater also. If it should begin to leak and drain dry, it could burn out.

☐ Insulate the hot water pipes between the heater and the faucets to reduce the amount of water that must be run to get hot water. Smaller hot water piping will have a similar effect.

☐ Locate the water heater near the points of most hot water use. Consider a separate water heater for distant bathrooms.